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| **Lesson Title: Toy Car Lab** |
| **Subject area / course / grade level: Science; Motion; 4th grade** |
| **Introduction: Motion is part of everyday life. *Speed* is defined as distance traveled per unit time. It can be calculated by using the formula: S=D/T. *Velocity* is speed and direction. *Acceleration* is any change in velocity; or any change in speed or direction.** |
| **Lesson Length: 2-60 minutes blocks** |
| **Materials:**   * **Interactive notebook/pencil** * **Stop watch** * **6 toy cars (3 toy cars with both batteries and 3 with 1 battery and 1 conductor)**   + **I used a crayon cut to fit wrapped in aluminum foil** * **Meter stick** * **Outside chalk** * **Large white boards/dry erase markers** |
| **Lesson Overview: Students will design and conduct an experiment to find the speed of a toy car.** |
| **Tennessee Standards:**  **GLE 0407.11.3 Investigate the relationship between the speed of an object and the distance traveled during a certain time period.**  **SPI 0407.11.1 Describe the position of an object relative to fixed reference points.**  **SPI 0407.11.2 Identify factors that influence the motion of an object.**  **SPI 0407.11.3 Determine the relationship between speed and distance traveled over time.** |
| **Lesson objective(s):**   * **TLW investigate why two identical cars have different speeds.** * **TLW measure the distance their toy car traveled in four-second increments 8 times.** * **TLW analyze data to notice any patterns and form conclusions.** * **TLW graph their data on a line graph.** |
| **ENGAGEMENT:**   * **Using their interactive notebooks, students will be asked to observe the motion of two toy cars (one fast and one slow) and to describe their motion. They are then asked to predict what a graph of distance versus time would look like. After time is given for students to record their personal thoughts, we discuss whole group and have a shared list of our thoughts and ideas. (Try not to make any statements as to whether the information presented is correct or incorrect.) Make sure the following questions have been addressed during the discussion:**   **1. How does the motion of the two cars differ?**  **2. Is the speed of the cars changing or staying the same?**  **3. How can we determine if the speed is staying constant?**  **4. What equipment would we need to do this investigation?**  **5. How would we record our data?**   * **Then in their interactive notebook, each student will write their purpose/question, hypothesis, materials, procedures, and tables to collect their data. Model the tables.** |
| **EXPLORATION:**   * **Divide students into groups of four. Provide students with meter sticks, stopwatches, sidewalk chalk, and Battery Operated Toy Cars and explain to them good techniques needed to collect data.** * **Students should place a chalk line to note on the pavement to mark the zero position, turn the car on and place it on the floor so that the back of the car is lined up with the starting line. Release the car and start the stopwatch at the same time. After 4 seconds, the students need to place a chalk line on the pavement behind the car to make the car’s position. Repeat this at the 8-second mark, 12 seconds and so on until they get to the 32-second mark. Stop the car and use a meter stick to measure the distance from the zero position to each chalk line. Record the distances in the data table. Do this three times for three trials. Use three different chalk colors to separate each trial.** * **Have each group present their data table for trial 1 on their whiteboards to show to the class.** |
| **EXPLANATION:**   * **After all groups have finished collecting their data, ask the students if they are able to determine from the data table if the toy cars were moving at a constant speed. Ask for suggestions. Then model one example of how to subtract the 2nd number from the first number.** * **Have each group graph their data onto the large white boards. After each group has graphed their data, have them present them to the class. Ask the following questions:**   **1. What do all of the graphs have in common?**  **2. What do they think the straight-line means?**  **3. Are there any differences in the graphs?**  **4. What is the formula for speed?**  **5. What part of this graph represents speed?**  **6. What does a graph with constant speed look like?**  **7. How would a graph with speed that is changing appear?**  **8. How do the graphs from the slow cars differ from the graphs of the fast cars?**  **9. What is causing the difference in distance?** |
| **ELABORATION:**   * **Open the battery compartments of a fast and a slow car and allow the students to see what has been done to each car.**   **1. Ask the students about how the force applied by the battery is different between the cars. If each battery is able to apply a certain amount of force to the gear system of the car, then what happens to the force when one battery is removed?**  **2. What happens to the distance when the force is decreased?**  **After the discussion, allow each student to rewrap their data on graph paper and glue in their interactive notebooks.** |
| **EVALUATION**   * **Students need to write a conclusion to their lab activity. Questions that need to be answered in their lab books:**   **1. Describe the motion of the toy car. How do you know?**  **2. What does a graph of an object with constant speed look like?**  **3. How does a graph of a fast object differ from the graph of a slow object?**  **4. How does the force applied to the car (from the battery) affect the distance the car travels?**  **5. Using the formula speed = distance/time, calculate the speed of your toy car.** |